

PRELIMINARY DATA SUMMARY

June 1989

U.S. Army Engineer Waterways Experiment Station
Coastal Engineering Research Center
Field Research Facility
Duck, North Carolina

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CERC Field Research Facility
Duck, North Carolina

This report provides a summary of basic oceanographic, meteorological and bottom profile data for the month. The data were obtained as part of the Measurements and Analysis work units at the U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's Field Research Facility (FRF) in Duck, North Carolina. The FRF staff collected and analyzed these data. These summaries are intended to make the data readily available to all FRF users, and comments on their content and usefulness are invited.

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PART I: INTRODUCTION

The U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's (CERC's) Field Research Facility (FRF) is located on the Outer Banks of North Carolina, near the village of Duck (Figure 1).

The FRF research program provides a means for obtaining high-quality field data, particularly during storms, in support of the U.S. Army Corps of Engineers' coastal engineering research missions. The research pier is a reinforced concrete structure supported on 0.9-m-diam steel piles spaced 12.2 m apart along the pier's length and 4.6 m apart across the width. The pier deck is 6.1 m wide and extends from behind the duneline to about the 6-m water depth contour at a height of 7.6 m above the National Geodetic Vertical Datum (NGVD). In addition, a main building contains offices, an instrument repair shop, and a data acquisition room.

One of the responsibilities of the FRF research program is the collection, analysis and dissemination of data on local oceanographic and meteorological conditions. Bottom profiles along both sides of the pier and periodic bathymetric surveys are also performed.

This summary is intended to provide basic data as soon as possible after they are obtained. Questions and/or comments concerning the data may be directed to Mr. Michael W. Leffler at (919) 261-3511.

Part II presents the meteorological data; Parts III through VI present oceanographic data; Part VII presents nearshore profiles and bathymetry; and Part VIII, if included, documents special events that occurred at the FRF during the month.

Table 1 is a list of instruments used, their operational status during the month, and the data collection status. Figure 2 identifies the location of the instruments. The water depths at the wave gages and current meters vary and may be determined from information contained in Figure 7. Other installation information is contained in Table 1.

Times given in the report, unless otherwise specified, are referenced to eastern standard time (EST).

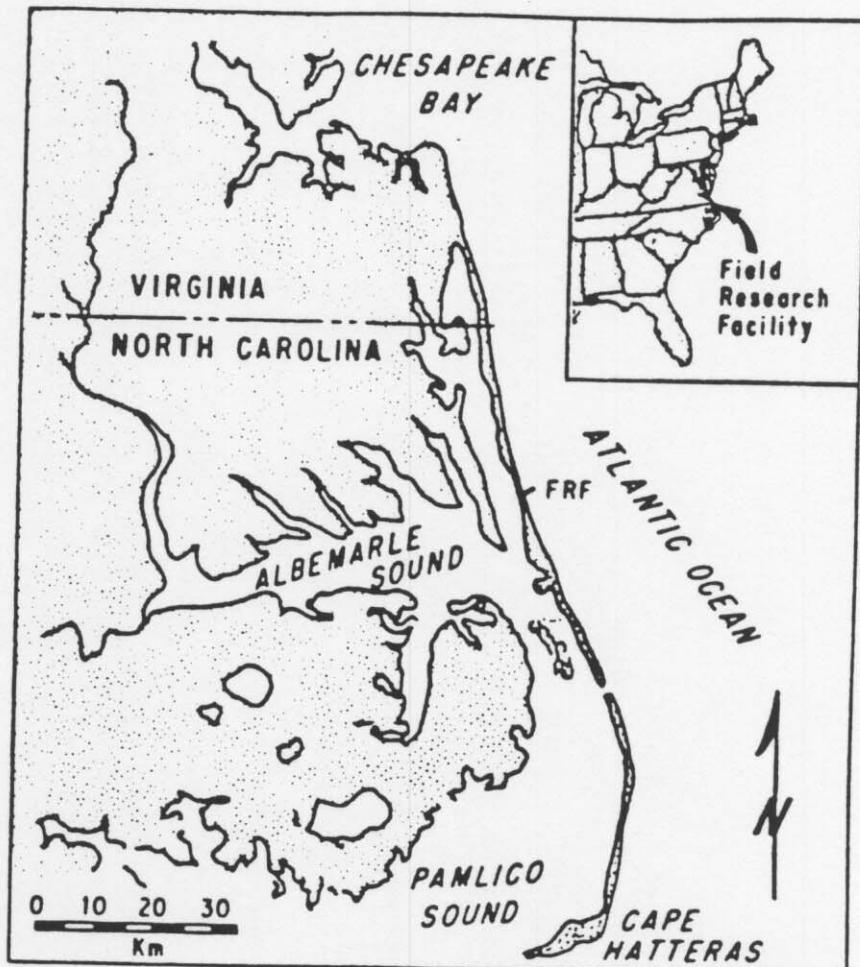


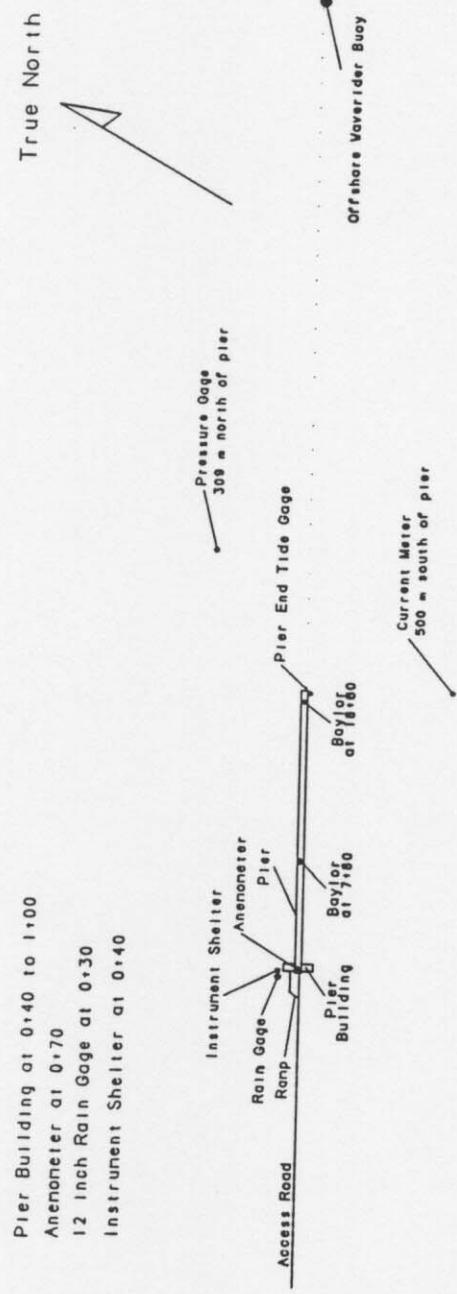
Figure 1. FRF location map

Table 1: Instrument Status/Data Availability

JUN 1989

Gage ID	Description/Remarks	Depth at Sensor		Day of the month																														
				1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	
616	Barometric Pressure		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Analog Record	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
604	Precipitation		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
624	Air Temperature		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
932	Anemometer at Seaward End of Pier Elevation 19 m (NGVD)		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	/	/	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Analog Record	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
645	Baylor staff at station 7+80 on FRF pier	see Figure 7	Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
625	Baylor staff at station 18+60 on FRF pier	see Figure 7	Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
111	Pressure gage 309 m north of FRF pier (0.9 km offshore)	Approx. 7.8 m NGVD	Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
630	Waverider buoy 6.0 km offshore	Approx. 23 m NGVD	Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
			Data Collected	*	*	/	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	/
679	Current meter 500 m south of FRF pier (0.6 km offshore)	see Figure 7	Gage Status	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
			Data Collected	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
865-1370	NOAA tide station at seaward end of FRF pier		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Supplemental Observations (daily oceanographic and meteorological observations)		Daily observation	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Gage Status	Daily Observation	Analog Record	Data Collected
Operational = *	Complete = *	Complete = *	All = *
Partial = /	Partial = /	Partial = /	Partial = /
Non-Operational = -	None = -	None = -	None = -



CURRI TUCK SOUND

ATLANTIC OCEAN

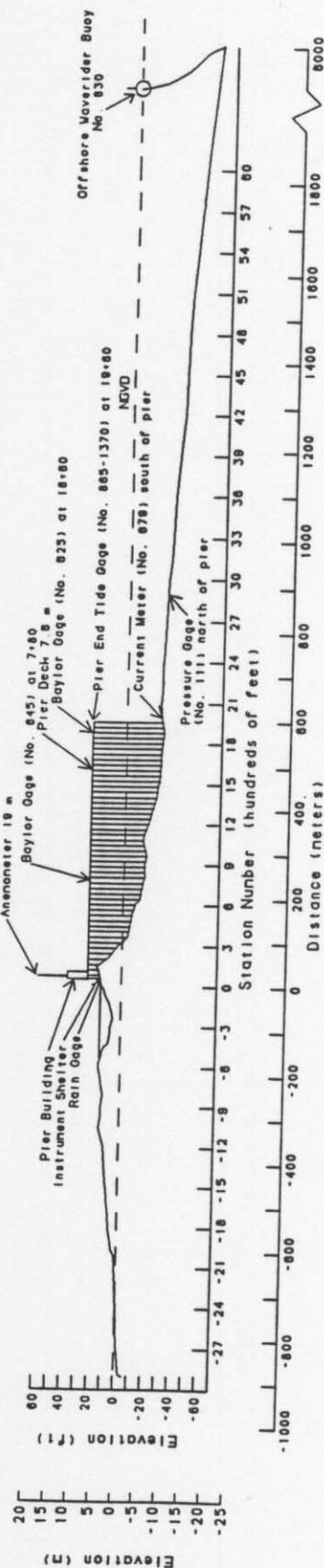


Figure 2. Instrument locations at FRF (all elevations from NGVD, all distances from FRF baseline).

PART II: METEOROLOGICAL DATA

A variety of instruments have been installed at the FRF (Figure 2) to monitor the meteorological conditions. The data presented in Table 2 are collected and stored on magnetic tape using a Digital Equipment Corporation VAX 11/750. For each instrument identified in Table 1 as having analog outputs, chart records are obtained, a log is maintained and the records are stored for future reference.

Winds were measured on top of the laboratory building at an elevation of 19 m (Figure 2) using a Weather Measure Skyvane anemometer.

Monthly resultant wind speeds and directions are determined by vector averaging the data. Temperature and atmospheric pressure means are the average of the values presented for the month. Total precipitation is the sum for the month.

The following may be useful for converting the data in Table 2 to other frequently used units of measurement:

1. Millimeters (mm) to inches (in.) -
 $mm \times .03937 = in.$
2. Millibars (mb) to inches of mercury (in. Hg) -
 $mb \times 0.02953 = in. Hg$
3. Degrees Celsius (C) to degrees Fahrenheit (F) -
 $(C \times 9/5) + 32 = F$
4. Meters per second (m/s) to knots (kn) -
 $m/s \times 1.943 = kn$

Table 2: Meteorological Data

Jun 1989

Day	Hour	* Wind Speed m/sec	* Wind Direction deg TN	Temperature deg C	Atm Pressure mb	Precipitation mm
1	100	7	228	22.9	1017.9	0
	700	8	249	23.5	1017.5	0
	1300	4	220	31.0	1016.9	0
	1900			28.5	1014.8	0
2	100			25.3	1014.5	0
	700			26.1	1014.8	0
	1300	4	223	32.9	1012.8	0
	1900	4	248	29.9	1011.4	0
3	100	4	53	21.4	1011.8	0
	700	2	319	22.8	1014.2	0
	1300	4	118	27.3	1013.1	0
	1900	6	230	24.9	1010.8	0
4	100	10	216	25.0	1011.1	0
	700	8	215	25.8	1011.1	0
	1300	6	239	31.1	1011.1	0
	1900	6	193	24.2	1010.8	23
5	100	7	231	24.8	1012.1	0
	700	4	210	23.3	1012.8	0
	1300	4	221	28.8	1011.8	0
	1900	8	207	24.8	1011.1	9
6	100	9	259	23.5	1010.4	0
	700	11	218	23.7	1011.4	0
	1300	6	218	28.3	1010.8	0
	1900	8	189	24.9	1010.4	23
7	100	4	173	23.5	1010.8	0
	700	7	183	24.5	1010.8	0
	1300	7	180	24.6	1011.1	10
	1900	7	168	23.5	1011.1	0
8	100	6	180	22.2	1011.1	0
	700	4	236	24.5	1012.5	0
	1300			26.1	1012.5	0
	1900	8	190	25.1	1012.1	2
9	100	7	208	23.0	1011.4	3
	700	6	204	22.5	1011.1	5
	1300	9	185	27.1	1009.1	0
	1900	10	203	25.9	1007.4	4
10	100	10	221	24.5	1008.7	0
	700	4	268	25.0	1011.4	0
	1300	7	231	28.6	1011.8	0
	1900	4	262	26.8	1011.8	0
11	100	6	334	20.8	1013.1	0
	700	8	354	19.9	1016.9	0
	1300	6	21	21.3	1017.5	0
	1900	2	87	19.6	1017.2	0
12	100	3	152	18.2	1017.2	0
	700	2	182	23.1	1017.9	0
	1300			25.6	1016.5	0
	1900	8	182	24.2	1013.1	0
13	100	7	12	22.5	1010.4	0
	700	10	1	23.5	1009.8	0
	1300	6	240	30.3	1007.7	0
	1900	10	246	23.1	1007.0	0
14	100	6	257	23.5	1009.8	0
	700	4	216	25.5	1012.1	0
	1300	4	147	29.7	1012.5	0
	1900	7	168	28.3	1011.4	0
15	100	7	201	26.4	1012.8	0
	700	7	217	26.5	1014.5	0
	1300	8	189	33.0	1012.8	0
	1900	10	172	29.0	1013.5	0
16	100	6	185	25.9	1015.5	0
	700	9	172	26.5	1016.9	0
	1300	10	185	31.1	1016.5	0
	1900	9	169	27.6	1017.2	0

(Continued)

(Sheet 1 of 2)

Table 2: Meteorological Data

Jun 1989

Day	Hour	Wind	Wind	Temperature	Atm	Precipitation
		Speed m/sec	Direction deg TN	deg C	mb	mm
17	100	8	173	26.0	1017.9	0
	700	6	204	24.1	1020.6	0
	1300	5	127	22.1	1020.6	0
	1900	7	169	24.7	1018.6	0
18	100	6	200	24.3	1019.2	0
	700	6	204	24.9	1018.9	0
	1300	8	123	25.5	1018.6	0
	1900	3	125	23.0	1016.9	0
19	100	2	11	20.5	1017.5	0
	700	1	57	21.9	1017.9	0
	1300	3	29	26.4	1018.2	0
	1900	4	60	23.2	1016.9	0
20	100	3	95	22.6	1017.9	0
	700	4	167	25.8	1018.9	0
	1300	7	126	28.0	1018.2	0
	1900	6	162	26.6	1018.2	0
21	100	6	167	25.5	1018.9	0
	700	5	135	23.9	1020.3	0
	1300			24.0	1019.6	7
	1900			21.5	1018.6	4
22	100			22.1	1019.2	0
	700			23.1	1019.9	0
	1300	5	150	27.9	1018.6	0
	1900	4	130	21.2	1017.2	0
23	100	5	193	25.0	1016.9	0
	700	1	297	25.5	1016.5	0
	1300	1	178	23.5	1015.5	0
	1900	1	163	22.7	1013.1	0
24	100	3	325	21.8	1012.5	0
	700	4	334	22.6	1011.8	0
	1300	3	14	26.1	1011.8	0
	1900	4	31	23.6	1012.5	0
25	100	3	2	22.9	1013.8	0
	700	3	348	24.5	1014.5	0
	1300	3	29	27.4	1014.2	0
	1900	3	82	24.5	1013.1	0
26	100	5	178	24.5	1012.8	0
	700	2	200	24.3	1012.8	2
	1300	4	204	30.1	1011.1	0
	1900	3	191	26.4	1010.4	0
27	100	4	221	25.4	1010.8	0
	700	4	236	26.8	1010.8	0
	1300	4	132	31.8	1010.8	0
	1900	5	187	27.7	1010.8	0
28	100	7	182	26.5	1011.1	0
	700	8	196	26.3	1012.1	0
	1300	7	194	32.0	1011.4	0
	1900	2	349	23.6	1011.8	0
29	100	7	220	24.4	1012.1	25
	700	3	8	23.8	1014.2	0
	1300	9	8	25.0	1015.9	0
	1900	7	40	23.3	1016.5	0
30	100	8	27	22.6	1018.2	0
	700	8	26	22.9	1019.2	0
	1300	6	43	24.0	1019.2	0
	1900	6	32	22.6	1018.2	0
		Resultant 3	197	Mean 25.1	Mean 1014.1	Total 117

* Anemometer at end of pier used (gage No. 932) (Sheet 2 of 2)

PART III: WAVE DATA

Wave data are collected from two Baylor staff gages (Gages 625 and 645), a pressure wave gage (Gage 111) and a Waverider buoy (Gage 630) as shown in Table 1 and Figure 2. The data are collected, analyzed, and stored on magnetic tape using a Digital Equipment Corporation VAX 11/750 programmed to sample the wave gages every 6 hr (more frequently during storms) beginning at 0100, 0700, 1300, and 1900 EST. The sampling rate is two times per second for four contiguous 34-min records.

Wave height H_{mo} is an energy-based statistic equal to four times the standard deviation of the sea surface elevations. Wave height reported from the pressure gage has been compensated for hydrodynamic attenuation using linear wave theory. Wave period is identified from the computation of a variance (energy) spectrum with 60 deg of freedom calculated from a 34-min record. Peak wave period T_p is defined as the period associated with the maximum energy in the spectrum. When this analysis is complete, the data are written to magnetic tape.

Table 3 presents the wave heights and periods for each wave record obtained at 6 hr intervals during the month. The monthly means and standard deviations from the means shown in Table 3 are average values computed from this data. Figure 3 is a time history of all H_{mo} and T_p values obtained for all gages.

Differences in wave periods between wave gages (Table 3 and Figure 3) may be the result of wave breaking, wave reformation, or the presence of multiple wave trains containing nearly equal energy.

Table 3: Wave Data

Jun 1989

Day	Hour	645		625		111		630	
		Baylor at 7+80	Hmo,m	Baylor at 18+60	Hmo,m	Pressure Gage	Hmo,m	Offshr Wvrdr	T,sec
1	0100	0.27	6.24	0.38	6.24	0.41	7.11	0.53	6.56
	0700	0.29	5.12	0.38	6.56	0.41	6.56	0.51	7.11
	1300	0.27	4.83	0.33	8.83	0.36	8.53	0.37	7.31
	1900	0.24	5.82	0.31	13.47	0.36	8.00	0.41	5.12
2	0100	0.20	6.74	0.33	6.92	0.34	8.53	0.39	8.26
	0700	0.23	5.45	0.32	5.12	0.32	13.47	0.41	5.95
	1300	0.20	5.02	0.28	7.76	0.33	8.83	0.35	8.53
	1900	0.23	6.92	0.28	8.00	0.34	8.26	0.40	7.11
3	0100	0.29	13.47	0.36	8.83	0.36	7.53	0.44	8.26
	0700	0.19	9.14	0.33	9.14	0.35	8.83	0.36	8.26
	1300	0.23	2.07	0.48	8.83	0.30	7.53	0.34	8.00
	1900	0.25	7.76	0.56	8.53	0.33	8.83	0.52	3.56
4	0100	0.21	4.49	0.43	12.19	0.31	3.24	0.65	3.66
	0700	0.21	5.45	0.47	8.26	0.31	12.19	0.55	4.49
	1300	0.23	5.33	0.41	10.67	0.37	11.64	0.48	5.22
	1900	0.31	7.76	0.34	8.26	0.36	6.24	0.45	6.24
5	0100	0.19	5.57	0.40	7.11	0.36	8.53	0.49	6.40
	0700	0.26	5.57	0.39	8.83	0.38	8.83	0.54	6.40
	1300	0.22	5.82	0.40	8.83	0.35	8.53	0.49	5.95
	1900	0.38	5.45	0.49	5.45	0.50	5.69	0.63	5.12
6	0100	0.31	5.69	0.45	6.09	0.44	6.09	0.68	5.69
	0700	0.31	7.11	0.43	6.74	0.41	6.92	0.71	6.40
	1300	0.34	5.57	0.56	6.74	0.44	8.26	0.58	6.56
	1900	0.34	5.12	0.48	8.53	0.48	8.26	0.64	5.22
7	0100	0.31	5.57	0.43	9.48	0.44	8.83	0.55	5.95
	0700	0.46	5.57	0.63	5.57	0.60	5.45	0.75	5.95
	1300	0.56	6.40	0.81	6.56	0.73	6.24	0.89	6.24
	1900	0.45	6.24	*	0.67	6.24	0.81	6.24	*
8	0100	0.48	6.24	*	0.68	6.56	0.85	6.24	*
	0700	0.47	5.95	*	0.68	5.95	0.77	6.40	*
	1300	0.35	5.95	*	0.52	6.56	0.69	6.09	*
	1900	0.37	6.24	*	0.57	6.40	0.64	6.40	*
9	0100	0.39	5.45	*	0.61	8.83	0.65	6.74	*
	0700	0.35	6.09	*	0.55	8.53	0.69	5.95	*
	1300	0.34	6.92	0.52	8.83	0.55	8.83	0.81	7.31
	1900	0.47	7.11	0.64	7.31	0.61	6.92	0.98	7.11
10	0100	0.31	7.53	0.45	8.83	0.54	7.76	0.80	7.11
	0700	0.27	7.31	0.47	9.48	0.47	9.14	0.61	9.14
	1300	0.32	8.83	0.42	7.11	0.52	9.48	0.64	7.31
	1900	0.30	5.33	0.44	8.83	0.46	8.53	0.52	8.83
11	0100	0.27	9.14	0.34	9.14	0.41	9.48	0.43	8.53
	0700	0.75	4.57	1.04	4.34	0.96	4.41	1.02	4.27
	1300	0.60	5.12	0.79	4.92	0.85	5.02	0.95	4.92
	1900	0.56	5.69	0.63	5.45	0.62	5.12	0.88	5.12
12	0100	0.30	5.22	0.44	8.83	0.47	8.26	0.61	4.66
	0700	0.28	4.49	0.43	8.00	0.43	9.85	0.45	9.48
	1300	0.35	9.48	0.54	8.83	0.43	8.83	0.46	8.83
	1900	0.35	10.24	0.62	9.48	0.59	9.85	0.68	9.48
13	0100	0.28	9.85	0.44	9.48	0.46	9.85	0.56	8.00
	0700	0.29	4.74	0.46	10.24	0.43	10.24	0.68	4.74
	1300	0.19	9.48	0.36	9.48	0.39	9.85	0.54	9.48
	1900	*	0.41	8.83	0.37	9.14	0.85	3.71	*
14	0100	0.21	9.14	0.36	9.48	0.41	9.85	0.50	9.48
	0700	0.25	9.85	0.39	9.48	0.40	8.83	0.50	7.31
	1300	0.34	9.14	0.36	8.83	0.41	9.14	0.49	9.14
	1900	0.25	9.14	0.39	8.83	0.37	9.48	0.50	8.83
15	0100	0.32	6.09	0.40	6.09	0.45	6.09	0.54	6.09
	0700	0.30	6.40	0.39	8.83	0.43	8.53	0.51	5.82
	1300	0.33	5.82	0.44	5.69	0.45	5.82	0.55	8.53
	1900	0.32	6.56	0.41	8.53	0.41	8.83	0.57	5.69
16	0100	0.24	6.74	0.38	8.53	0.36	8.83	0.47	8.53
	0700	0.22	9.48	0.35	8.53	0.38	9.85	0.50	8.53
	1300	0.34	4.92	0.51	8.26	0.51	9.48	0.64	9.48
	1900	0.40	4.83	0.48	9.48	0.57	9.48	0.75	5.02

* Electronic problems

(Continued)

Table 3: Wave Data

Jun 1989

Day	Hour	645		625		111		630	
		Baylor	at 7+80	Baylor	at 18+60	Pressure	Gage	Offshsr	Wvldr
		Hmo,m	T,sec	Hmo,m	T,sec	Hmo,m	T,sec	Hmo,m	T,sec
17	0100	0.35	9.48	0.56	9.14	0.61	9.14	0.73	8.83
	0700	0.40	5.45	0.57	9.14	0.60	9.14	0.70	9.14
	1300	0.40	5.45	0.60	8.83	0.60	8.53	0.64	8.53
	1900	0.31	5.02	0.49	8.83	0.57	8.53	0.67	8.53
18	0100	*		0.44	8.53	0.46	8.83	0.50	8.53
	0700	0.26	9.48	0.43	9.14	0.48	9.14	0.52	8.26
	1300	0.28	4.57	0.47	9.14	0.48	8.00	0.53	9.48
	1900	0.23	9.14	0.38	9.48	0.46	9.14	0.47	9.48
19	0100	0.26	10.24	0.37	9.48	0.39	8.53	0.42	9.48
	0700	*		0.40	9.48	0.42	9.85	0.46	8.26
	1300	0.32	8.53	0.40	8.83	0.41	9.14	0.44	8.83
	1900	0.25	8.53	0.42	8.26	0.41	9.48	0.46	9.48
20	0100	0.24	9.85	0.41	9.85	0.40	9.48	0.45	8.26
	0700	0.25	8.83	0.38	9.48	0.41	8.53	0.49	8.53
	1300	0.26	7.76	0.49	9.14	0.39	9.48	0.46	8.83
	1900	0.26	7.31	0.40	7.76	0.43	7.76	0.51	7.53
21	0100	0.25	7.31	0.44	7.76	0.39	8.53	0.51	8.00
	0700	0.23	7.53	0.41	9.14	0.42	8.26	0.51	7.76
	1300	0.30	7.53	0.48	8.00	0.41	7.76	0.49	7.31
	1900	0.29	8.83	0.44	7.31	0.46	6.40	0.53	6.74
22	0100	0.26	8.26	0.41	8.83	0.39	7.76	0.46	7.11
	0700	0.26	9.14	0.36	7.31	0.38	8.53	0.44	8.00
	1300	0.26	9.48	0.41	8.83	0.39	9.48	0.47	7.76
	1900	*		0.37	8.26	0.40	8.53	0.46	8.53
23	0100	*		0.37	14.22	0.41	13.47	0.43	9.14
	0700	0.24	12.80	0.42	13.47	0.48	12.80	0.48	12.80
	1300	0.26	12.19	0.44	12.19	0.50	12.19	0.50	12.19
	1900	0.26	11.64	0.44	11.64	0.54	11.64	0.49	11.64
24	0100	0.24	11.13	0.40	11.64	0.46	11.13	0.46	11.64
	0700	0.25	9.85	0.43	10.24	0.42	10.67	0.41	10.24
	1300	0.27	10.67	0.38	10.67	0.42	10.67	0.44	10.24
	1900	0.38	3.37	0.54	10.24	0.52	10.24	0.54	3.51
25	0100	0.36	10.67	0.53	5.82	0.52	9.85	0.61	10.24
	0700	0.36	5.12	0.68	5.22	0.59	5.33	0.65	5.12
	1300	0.39	5.22	0.57	8.53	0.55	9.85	0.58	10.24
	1900	0.40	9.85	0.65	9.85	0.61	9.48	0.60	9.85
26	0100	0.35	10.24	0.72	9.14	0.77	10.24	0.72	9.85
	0700	0.43	8.83	0.79	9.48	0.74	9.85	0.73	9.48
	1300	0.45	10.24	0.70	9.85	0.73	9.85	0.73	9.14
	1900	0.42	9.14	0.82	8.53	0.71	8.53	0.74	8.00
27	0100	0.32	8.83	0.67	9.14	0.66	8.26	0.71	8.83
	0700	0.34	8.53	0.71	8.53	0.64	8.26	0.64	8.53
	1300	0.36	7.76	0.57	8.00	0.65	8.53	0.63	9.14
	1900	0.33	8.26	0.60	8.26	0.51	8.00	0.56	8.00
28	0100	0.27	7.76	0.53	10.24	0.56	10.24	0.63	9.85
	0700	0.22	9.85	0.48	9.85	0.51	9.48	0.56	9.48
	1300	0.19	9.14	0.39	9.14	0.40	8.26	0.44	9.48
	1900	0.34	2.81	0.50	9.14	0.41	9.14	0.56	8.83
29	0100	0.17	8.00	0.28	8.53	0.32	8.00	0.34	8.53
	0700	0.19	3.33	0.28	8.26	0.29	8.53	0.33	8.00
	1300	0.71	3.94	0.83	4.00	0.97	3.94	1.03	4.66
	1900	0.81	5.95	0.86	5.82	0.86	5.57	1.12	5.57
30	0100	0.76	6.24	0.85	6.24	0.79	5.95	*	
	0700	0.86	5.82	0.88	5.82	0.95	5.69	*	
	1300	0.75	5.69	0.93	5.82	0.91	5.82	1.03	5.82
	1900	0.57	4.92	0.71	5.82	0.74	5.45	0.77	5.22
Mean		0.33	7.23	0.49	8.48	0.50	8.45	0.58	7.61
Std dev		0.13	2.22	0.15	1.81	0.15	1.84	0.16	1.90

* Electronic problems

(Sheet 2 of 2)

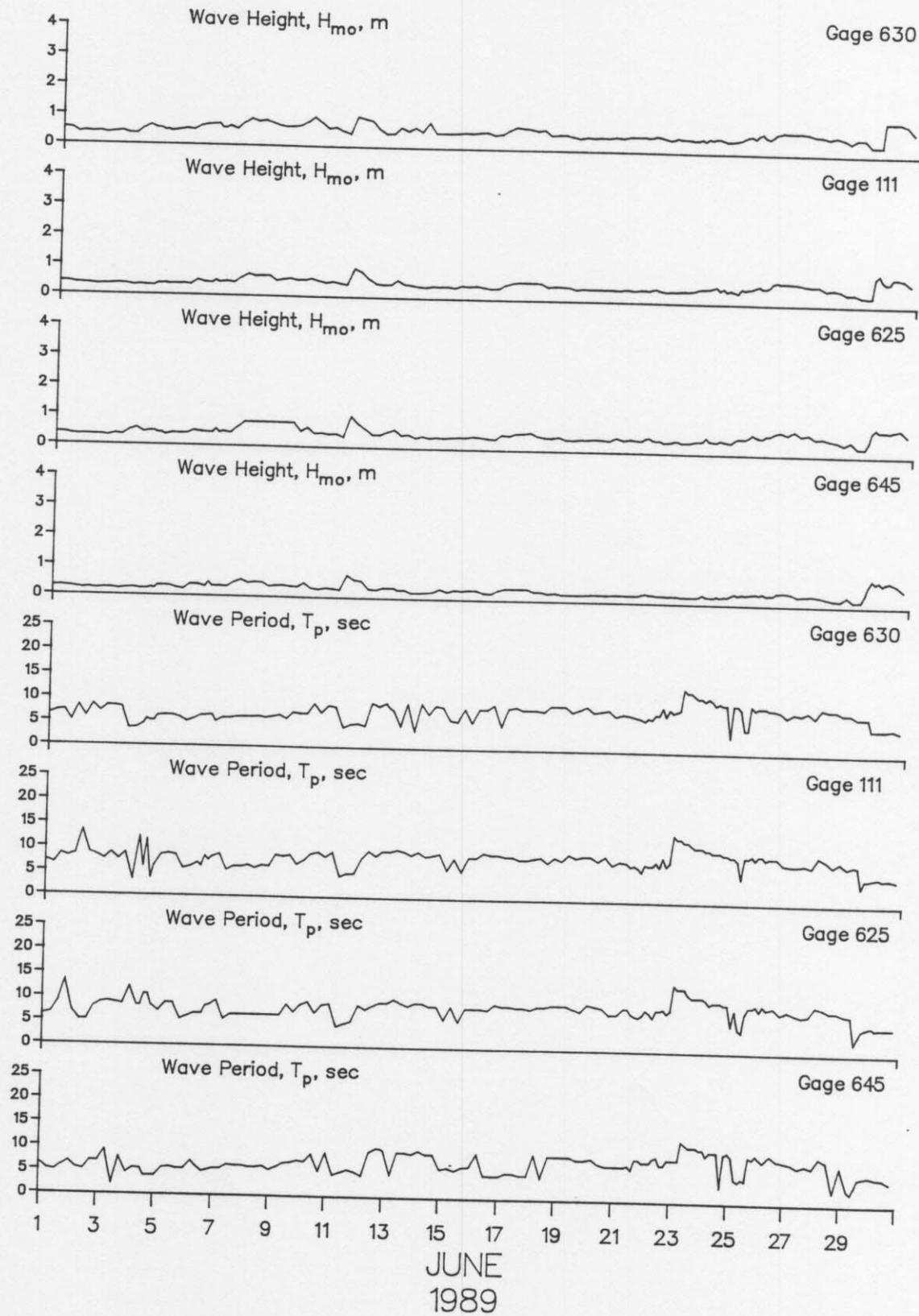


Figure 3. Time history of wave heights and periods

PART IV: CURRENT DATA

Current data (Table 4) are collected from a Marsh-McBirney electromagnetic biaxial current meter (Table 1 and Figure 2) and by visually observing the movement of dye on the water surface in the surf and at the seaward end of the pier, as well as 500 m updrift of the pier 12 m offshore.

Since the shoreline orientation is approximately N20W, longshore currents flow either toward 340 deg (i.e. northward) or toward 160 deg (i.e. southward). Similarly, cross-shore currents are either onshore (westward) or offshore (eastward).

All current speeds are given in centimeters per second (cm/sec). Resultant speeds and directions are determined by vector averaging the data.

Table 4: Current Data
Jun 1989

Day	Pier Measurements						Beach Measurements (500m Updrift)			Current Meter	
	Alongshore Cross-shore Resultant	Dye at (579 m) (surface)	Speed	Dir	Dye at Mid-Surf Zone (surface) Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface)	Location	Speed	Dir
1 0100-Along Cross Result											
1 0700-Along Cross Result		0				10	N				
1 1300-Along Cross Result		6 off			165	6 off		64 N	South		
1 1900-Along Cross Result		6 70				11	11				
2 0100-Along Cross Result											
2 0700-Along Cross Result		44 S				9 N					
2 1300-Along Cross Result		13 off			152	5 off		27 N	South		
2 1900-Along Cross Result		45 143				10 11					
3 0100-Along Cross Result											
3 0700-Along Cross Result		47 S				13 S					
3 1300-Along Cross Result		0 152				0 13		24 N	North		Gage Inoperative
3 1900-Along Cross Result		47 160				160					
4 0100-Along Cross Result											
4 0700-Along Cross Result		14 N				17 N					
4 1300-Along Cross Result		16 off			152	5 off		11 N	South		
4 1900-Along Cross Result		21 30				18 357					
5 0100-Along Cross Result											
5 0700-Along Cross Result		12 N				9 N					
5 1300-Along Cross Result		1 on			152	7 off		5 N	South		
5 1900-Along Cross Result		13 334				11 17					

KEY = All speeds in cm/sec
N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

Table 4: Current Data (Continued)
Jun 1989

Alongshore Cross-shore Resultant Time Day	Pier Measurements				Beach Measurements (500m Updrift)				Current Meter		
	Dye at (579 m) (surface)	Speed	Dir	Dye at Mid-Surf Zone (surface)	Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface)	Location	Speed	Dir
6 0100-Along Cross Result											
6 0700-Along Cross Result	13 30 33	N off 47		152		14 8 16	N off 9	14	South	14	N
6 1300-Along Cross Result											
6 1900-Along Cross Result											
7 0100-Along Cross Result											
7 0700-Along Cross Result	23 7 24	N off 357		152		47 14 49	N off 357	101	South	101	N
7 1300-Along Cross Result											
7 1900-Along Cross Result											
8 0100-Along Cross Result											
8 0700-Along Cross Result	21 6 22	N off 357		177		18 2 19	N off 346	46	South	46	N
8 1300-Along Cross Result											
8 1900-Along Cross Result											
9 0100-Along Cross Result											
9 0700-Along Cross Result	34 0 34	N off 340		177		51 3 51	N off 343	79	South	79	N
9 1300-Along Cross Result											
9 1900-Along Cross Result											
10 0100-Along Cross Result											
10 0700-Along Cross Result	0 12 12			165		24 11 27	N off 4	46	South	46	N
10 1300-Along Cross Result											
10 1900-Along Cross Result											

Gage
Inoperative

KEY = All speeds in cm/sec
N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

Table 4: Current Data (Continued)
Jun 1989

Day	Alongshore Cross-shore Resultant Time	Pier Measurements				Beach Measurements (500m Updrift)			Current Meter		
		Dye at (579 m) (surface) Speed	Dir	Dye at Mid-Surf Zone (surface) Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface) Location	Speed	Dir	Speed	Dir
11 0100-Along Cross Result											
11 0700-Along Cross Result	23 9 on	S		189	44 2	S off			73	S	
11 1300-Along Cross Result	24	182			44	157					
11 1900-Along Cross Result											
12 0100-Along Cross Result											
12 0700-Along Cross Result	55 0	S		177	10 1	N off			6	N	
12 1300-Along Cross Result	55	160			10 10	346	South				
12 1900-Along Cross Result											
13 0100-Along Cross Result											
13 0700-Along Cross Result	0 20 off			165	16 5 off				44	N	
13 1300-Along Cross Result	20 70				16 357						Gage Inoperative
13 1900-Along Cross Result											
14 0100-Along Cross Result											
14 0700-Along Cross Result	11 5 off	N		165	10 6 off				94	N	
14 1300-Along Cross Result	12 4				12 11		South				
14 1900-Along Cross Result											
15 0100-Along Cross Result											
15 0700-Along Cross Result	36 25 off	S		165	5 6. off				0		
15 1300-Along Cross Result	44 125				8 30		South				
15 1900-Along Cross Result											

KEY = All speeds in cm/sec
 N = Northward, Shore parallel
 S = Southward, Shore parallel
 on = onshore off = offshore

Table 4: Current Data (Continued)
Jun 1989

Day	Time	Pier Measurements			Beach Measurements (500m Updrift)			Current Meter			
		Dye at (579 m) (surface)	Speed	Dir	Dye at Mid-Surf Zone (surface)	Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface)	Location	Speed
16	0100-Along Cross Result									South	
16	0700-Along Cross Result	18 9 21	N off 7		165		16 6 17	N off 359		27 N	
16	1300-Along Cross Result										
16	1900-Along Cross Result										
17	0100-Along Cross Result										
17	0700-Along Cross Result	0 12 12			165		20 6 21	N off 357		31 N	
17	1300-Along Cross Result										
17	1900-Along Cross Result										
18	0100-Along Cross Result										
18	0700-Along Cross Result	0 6 6			152		16 0 16	N		13 N	
18	1300-Along Cross Result										Gage
18	1900-Along Cross Result										Imperative
19	0100-Along Cross Result										
19	0700-Along Cross Result	12 1 12	N on 334		152		7 1 7	N on 334		6 N	
19	1300-Along Cross Result										
19	1900-Along Cross Result										
20	0100-Along Cross Result										
20	0700-Along Cross Result	41 0 41	S off 160		152		7 2 7	N off 359		33 N	
20	1300-Along Cross Result										
20	1900-Along Cross Result										

KEY = All speeds in cm/sec
 N = Northward, Shore parallel
 S = Southward, Shore parallel
 on = onshore off = offshore

Table 4: Current Data (Continued)
Jun 1989

Alongshore Cross-shore Resultant Time Day	Pier Measurements						Beach Measurements (500m Updrift)			Current Meter	
	Dye at (579 m) (surface)		Dye at Mid-Surf Zone (surface) Distance from Baseline (m)		Speed		Dye 12m offshore (surface) Location		Speed	Dir	
	Speed	Dir									
21 0100-Along Cross Result											
21 0700-Along Cross Result	24 7 25	N on 323		165		18 2 18	N on 334		8	N	
21 1300-Along Cross Result											
21 1900-Along Cross Result											
22 0100-Along Cross Result											
22 0700-Along Cross Result	9 5 11	N on 11		165		10 7 12	N off 17		9	N	
22 1300-Along Cross Result											
22 1900-Along Cross Result											
23 0100-Along Cross Result											
23 0700-Along Cross Result	4 1 4	N off 349		165		0 0 0			9	S	
23 1300-Along Cross Result											Gage Inoperative
23 1900-Along Cross Result											
24 0100-Along Cross Result											
24 0700-Along Cross Result	51 0 51	S 160		152		12 2 12	S on 169		9	S	
24 1300-Along Cross Result											
24 1900-Along Cross Result											
25 0100-Along Cross Result											
25 0700-Along Cross Result	68 0 68	S 160		177		16 2 17	S on 166		9	S	
25 1300-Along Cross Result											
25 1900-Along Cross Result											

KEY = All speeds in cm/sec

N = Northward, Shore parallel

S = Southward, Shore parallel

on = onshore off = offshore

Table 4: Current Data (Concluded)
Jun 1989

Day	Time	Pier Measurements				Beach Measurements (500m Updrift)				Current Meter	
		Dye at (579 m) (surface)	Speed	Dir	Dye at Mid-Surf Zone (surface)	Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface)	Location	Speed
26	0100-Along Cross Result									South	
26	0700-Along Cross Result	0 3 3	— off 70		165	0 9 9	— off 70			3 S	
26	1300-Along Cross Result										
26	1900-Along Cross Result										
27	0100-Along Cross Result										
27	0700-Along Cross Result	11 3 11	S on 174		165	20 8 21	S on 182			36 N	
27	1300-Along Cross Result										
27	1900-Along Cross Result										
28	0100-Along Cross Result										
28	0700-Along Cross Result	18 9 20	N off 7		165	11 5 12	N off 4			5 N	
28	1300-Along Cross Result										Gage Inoperative
28	1900-Along Cross Result										
29	0100-Along Cross Result										
29	0700-Along Cross Result	13 3 14	S off 149		165	20 1 20	S on 163			67 S	
29	1300-Along Cross Result										
29	1900-Along Cross Result										
30	0100-Along Cross Result										
30	0700-Along Cross Result	41 8 41	S on 171		177	44 11 45	S off 146			67 S	
30	1300-Along Cross Result										
30	1900-Along Cross Result										

KEY = All speeds in cm/sec
 N = Northward, Shore parallel
 S = Southward, Shore parallel
 on = onshore off = offshore

PART V: SUPPLEMENTAL OBSERVATIONS

Visual wave direction measurements (Table 5) of both the primary wave train (i.e. that having the larger wave heights) and the secondary wave train (which must be clearly distinguishable as a wave train separate from the primary waves but not surface chop or capillary waves) are taken daily at the seaward end of the pier. The direction of the primary wave train just north of the seaward end of the pier is also determined using a Raytheon Marine Pathfinder radar and measuring the alignment of the wave crests at approximately the same location as the visual measurements. The pier axis (considered perpendicular to the beach at the FRF) is orientated 70 deg east of true north; consequently, wave angles greater than 70 deg indicate that the waves were coming from the south side of the pier.

The width of the surf zone (seawardmost breaker position to shoreline) is determined from the pier deck.

Measurements of surface water temperature, density, and visibility are also taken daily at the seaward end of the pier. A jar along with a thermometer is lowered about 0.3 m into the water and allowed to remain for at least one minute. The jar is removed, the temperature read, and a hydrometer is used to determine the density. A Secchi disc is used to determine the surface visibility.

Table 5: Supplemental Observations

Jun 1989

Day	Time	Wave Approach		Radar Wave Angle deg from True N	Width of Surf Zone,m	Water Characteristics at Pier End		
		Primary	Secondary			Temp.,C	Density g/cc	Secchi Vis.,m
1	0820	125			13	14.5	1.0246	5.8
2	0740	140			7	20.0	1.0191	2.4
3	0802	10	120		9	20.0	1.0192	2.4
4	0757	25	160		9	15.0	1.0249	3.7
5	0709	110			5	16.7	1.0242	4.0
6	0741	130		95	11	14.5	1.0250	3.0
7	0737	120			17	15.0	1.0246	2.7
8	0840	125			22	16.7	1.0242	5.8
9	0735	130	10		16	15.0	1.0246	2.7
10	1120	125			18	15.0	1.0247	2.7
11	0927	15			28	18.4	1.0236	3.7
12	0726	100	30		17	20.5	1.0196	3.7
13	0653	120	95		11	20.0	1.0240	3.7
14	0705	350			9	20.0	1.0226	7.0
15	0725	135			9	20.0	1.0219	3.0
16	0745	140			8	16.7	1.0240	3.7
17	0825	115			15	16.6	1.0248	4.6
18	0610	120			9	16.1	1.0250	3.4
19	0708	50			11	20.0	1.0232	6.1
20	0650	105			9	23.8	1.0192	6.1
21	0721	125			3	20.0	1.0230	6.4
22	0745	125			7	17.8	1.0242	3.7
23	0735	115			7	16.7	1.0242	5.8
24	1000	70	0		4	23.4	1.0191	3.7
25	0720	105	30		12	23.9	1.0178	3.7
26	0712	90			18	22.2	1.0210	6.1
27	0819	90			18	25.4	1.0170	3.7
28	0736	115			4	19.5	1.0230	2.7
29	0750	5			9	23.4	1.0220	4.0
30	0752	30	90		18	24.5	1.0184	2.7

PART VI: WATER LEVELS

Since 1978, the National Oceanic and Atmospheric Administration (NOAA)/National Ocean Service (NOS) has operated a primary tide station (No. 865-1370) at the seaward end of the FRF pier. A Leupold-Stevens digital recording float-type tide gage is used to collect instantaneous water level data every 6 minutes throughout the month.

The variation in water level during the month is shown in Figure 4 along with a list of mean and extreme values. This presentation is useful in identifying effects of both meteorological and astronomical forces on the open coast water level.

Table 6 contains the time at the center of each 12.42-hr tidal cycle and the range, high, low, and mean water levels during each tidal cycle.

FRF Tide Heights

Jun 1989

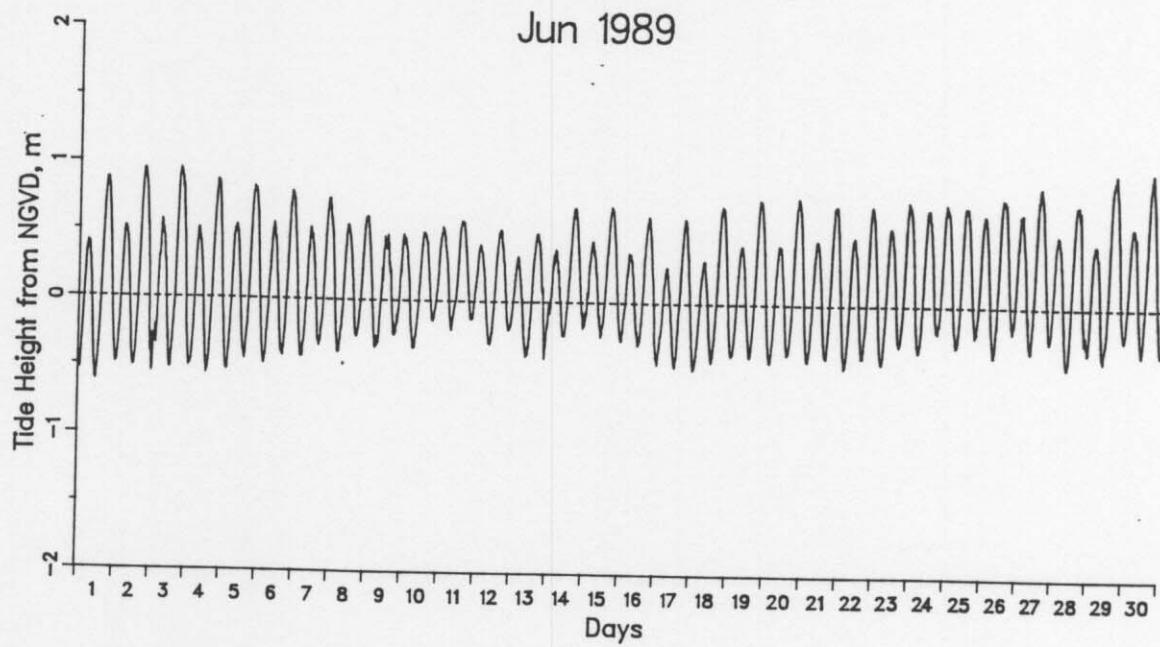


Figure 4. Water level time history

Monthly Water Levels, m NGVD

Extreme Low	=	-0.62	on day 1 at 1036 EST
Extreme High	=	1.00	on day 30 at 1718 EST
Monthly Mean	=	0.13	
Mean Low	=	-0.37	
Mean High	=	0.62	
Mean Range	=	1.00	

Table 6: Water Levels, m NGVD

		Jun 1989			
Mid-Cycle Day	Time	Low	High	Mean	Range
1	612	-0.62	0.41	-0.11	1.02
1	1837	-0.49	0.88	0.22	1.37
2	703	-0.51	0.52	0.00	1.03
2	1928	-0.55	0.95	0.27	1.50
3	753	-0.52	0.57	0.01	1.09
3	2018	-0.50	0.95	0.26	1.46
4	843	-0.56	0.51	-0.03	1.07
4	2109	-0.53	0.87	0.19	1.40
5	934	-0.45	0.54	0.03	0.99
5	2159	-0.48	0.83	0.21	1.31
6	1024	-0.42	0.56	0.04	0.98
6	2249	-0.43	0.79	0.20	1.22
7	1115	-0.34	0.53	0.06	0.87
7	2340	-0.39	0.74	0.20	1.13
8	1205	-0.29	0.55	0.11	0.84
9	30	-0.35	0.62	0.15	0.97
9	1255	-0.31	0.48	0.09	0.80
10	121	-0.35	0.48	0.08	0.84
10	1346	-0.26	0.50	0.15	0.77
11	211	-0.22	0.55	0.18	0.76
11	1436	-0.13	0.59	0.23	0.72
12	301	-0.32	0.42	0.07	0.73
12	1527	-0.23	0.53	0.15	0.76
13	352	-0.41	0.33	-0.04	0.74
13	1617	-0.42	0.50	0.11	0.92
14	442	-0.25	0.38	0.05	0.63
14	1707	-0.19	0.69	0.26	0.89
15	532	-0.26	0.45	0.09	0.70
15	1758	-0.28	0.70	0.24	0.99
16	623	-0.32	0.37	0.02	0.68
16	1848	-0.45	0.63	0.13	1.09
17	713	-0.48	0.27	-0.11	0.74
17	1938	-0.49	0.62	0.08	1.12
18	804	-0.44	0.31	-0.08	0.75
18	2029	-0.39	0.72	0.18	1.11
19	854	-0.40	0.43	0.00	0.83
19	2119	-0.44	0.77	0.19	1.20
20	944	-0.37	0.43	0.02	0.81
20	2210	-0.42	0.78	0.20	1.21
21	1035	-0.40	0.47	0.04	0.87
21	2300	-0.47	0.73	0.16	1.20
22	1125	-0.39	0.50	0.04	0.89
22	2350	-0.44	0.73	0.15	1.16
23	1216	-0.30	0.57	0.12	0.87
24	41	-0.35	0.76	0.22	1.11
24	1306	-0.20	0.71	0.24	0.91
25	131	-0.30	0.75	0.23	1.05
25	1356	-0.23	0.73	0.27	0.95
26	222	-0.37	0.67	0.17	1.05
26	1447	-0.19	0.79	0.32	0.98
27	312	-0.34	0.69	0.18	1.03
27	1537	-0.26	0.89	0.34	1.15
28	402	-0.45	0.53	0.06	0.98
28	1628	-0.34	0.76	0.24	1.10
29	453	-0.40	0.47	0.04	0.87
29	1718	-0.24	0.99	0.39	1.23
30	543	-0.35	0.60	0.14	0.95
30	1808	-0.35	1.00	0.36	1.35

PART VII: NEARSHORE PROFILES

A. Nearshore Profiles. In order to document profile response away from the pier, surveys of four profile lines extending 900 to 1,000 m from shore and located 489 and 581 m north and 517 and 608 m south of the FRF pier are conducted bi-weekly, after storms, and during more complete bathymetric surveys.

These profiles are obtained using the CRAB-Zeiss surveying system; a Zeiss Elta-2 first-order, self-recording electronic theodolite distance meter in combination with the Coastal Research Amphibious Buggy (CRAB), a 10.7 m high, self-powered, mobile tripod on wheels.

Figure 5 shows the last survey in May and the two surveys in June on profile line 188, located 517 m south of the pier. The only significant change was the development of a large berm on the foreshore (100 m) at the end of the month. Only minor changes are visible on the remainder of the profile.

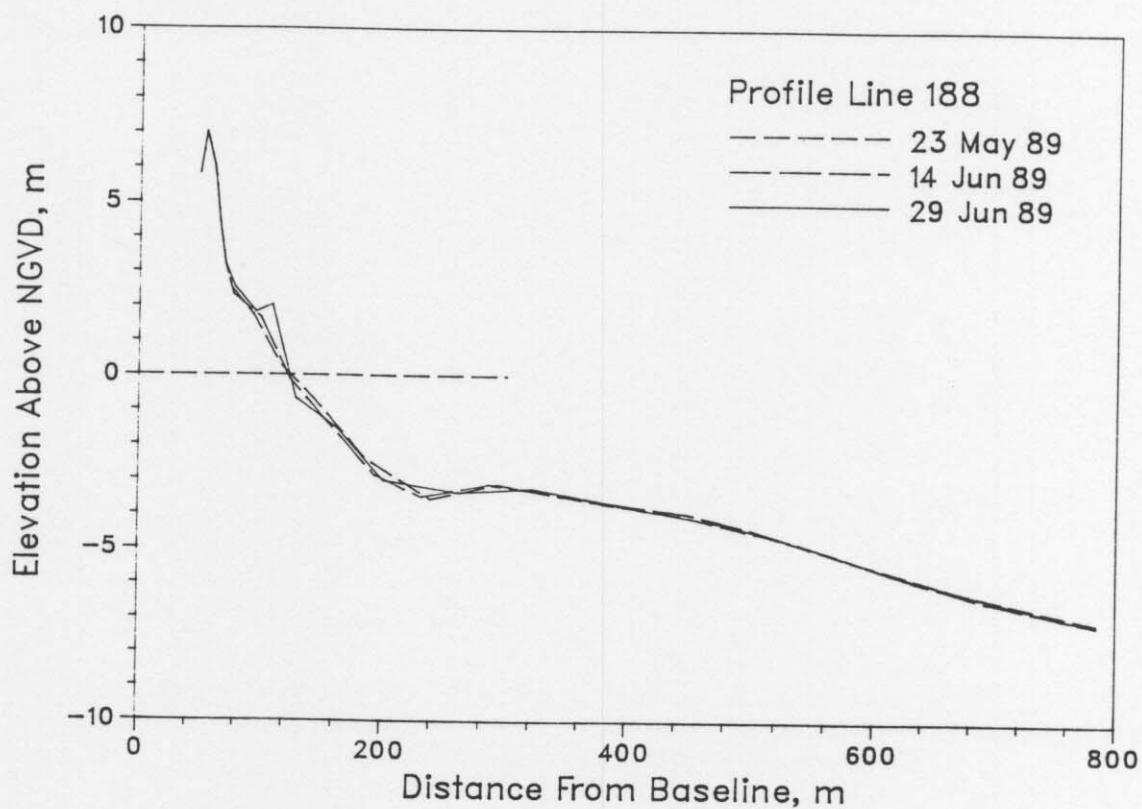


Figure 5. Monthly CRAB profiles on profile 188 - 517 m south of pier.

The profile envelope (Figure 6) reflects the maximum changes that occurred on the profile during 1988. The prominent change (100 m) visible on the foreshore is a result of the berm development late in the month.

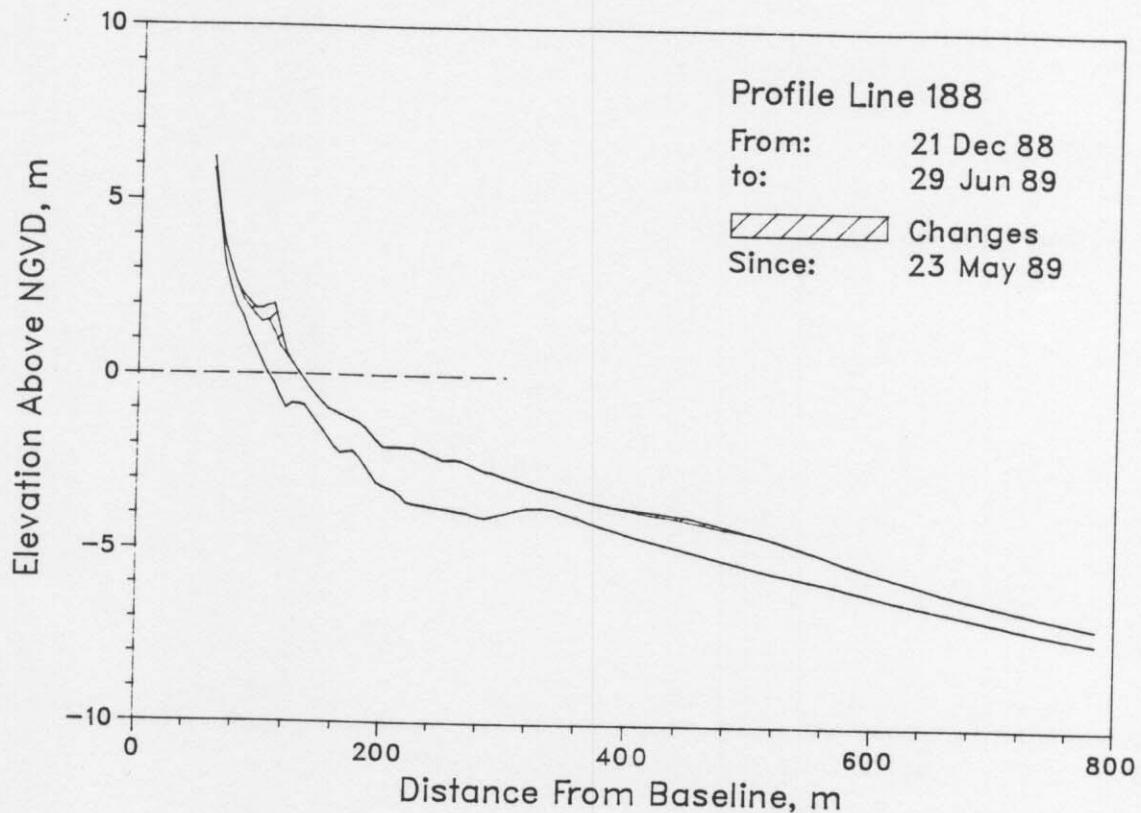


Figure 6. CRAB profile envelope - profile 188.

B. Bathymetry. Figure 7 includes a two- and three-dimensional contour map and a change plot derived from the bathymetric survey on 15 June. Wide contour lines on the change diagram represent eroded areas; thin lines indicate deposition.

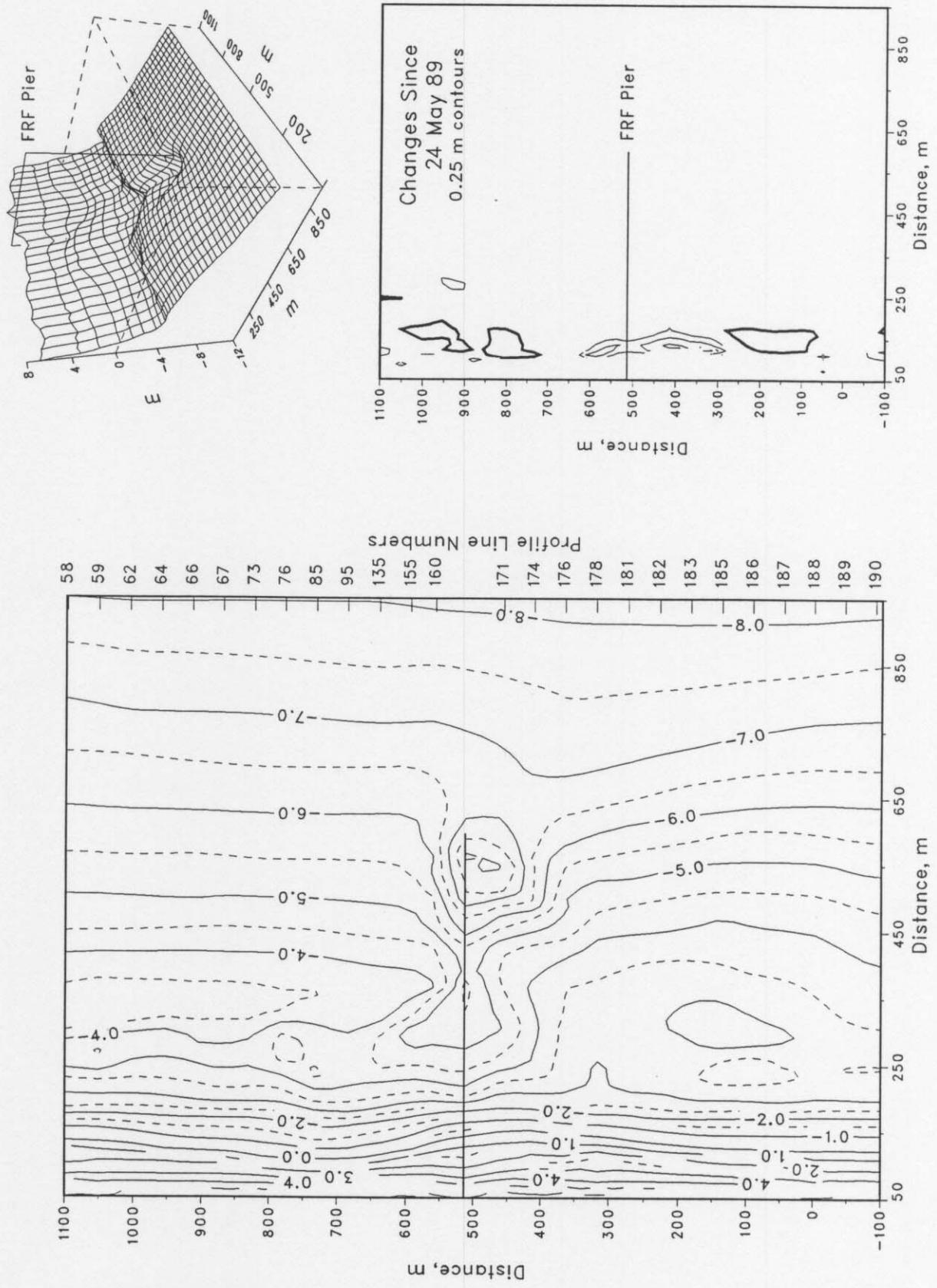


Figure 7. FRF bathymetry 15 Jun 89 depths relative to ngvd

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